Making hardware in Nairobi: Between revolutionary practices and restricting imaginations

Abstract

The first makerspace in Nairobi seems to revolutionize the development of hardware in Kenya by introducing new work possibilities for engineers and by turning stereotypes of the Global South (as mere technology recipient) and the Global North (as the only originator of tech innovation) upside down. Nevertheless, postcolonial power asymmetries persist in the relations between international investors and start-ups/makers. By drawing on ethnographic insights, the paper shows how the tech-deterministic and developmental imaginations of global investors and the branding of technology as developed "for Africa" are restricting Kenyan tech developers to only building technology with social impact. Potential customers in Kenya become homogenized as poor and in need of technological solutions, whereby their daily life context becomes 'othered' and exoticized as a coherent and rural 'Africa'. Therefore, the paper claims that practices of making, following a social-impact logic, constitute a performance of poverty, and that the daily negotiations between the investors' imaginations and the makers' technological ideas are performatively enacting norms of what – and what not – to build.

Introduction

> Do we have our own inherent culture that informs how we go about building stuff or are
> we just dancing to the tune of whoever wants to listen?!
>
>   (tech expert and researcher, interview, 2015)

All over the world, sites for technological innovation gain international awareness – be it Shenzhen in China, Cape Town in South Africa or Nairobi in Kenya. Accompanied by this awareness is the renaming and branding of those new(ly discovered)[1] places as emerging Silicon Valleys: Shenzhen as the "Silicon Valley for Hardware", Cape Town as "Silicon Cape" and Nairobi as "Silicon Savannah". The more success stories and products are covered by the media, the more people from 'long'-established places of tech production, like Silicon Valley or Europe, are visiting places that have not yet been in the spotlight of technological innovation. When Mark Zuckerberg visited Nairobi's tech scene in August 2016 to learn about technology that uses mobile money, it became clear that Nairobi's reputation as a place of tech innovation had spread to the top level of global tech gurus.

Since 2007, international awareness has been directed more and more towards Nairobi's tech scene. The starting points of this awareness, and Nairobi's reputation as a place for technological development, are said to be rooted in two innovations: Ushahidi and M-Pesa. Ushahidi (Kiswahili for testimony) is an open-source software with which everyone who has access to the Internet can map happenings. For instance, this software was used to follow and comment on the post-election violence in Kenya in 2007/08, in order to make the riots transparent (Manske, 2014, p.14; Ushahidi, 2017).

While Ushahidi was spreading, one of the largest mobile network operators, Safaricom, introduced M-Pesa in Kenya. M-Pesa (M stands for mobile and *pesa* means money in Kiswahili) is an application for mobile phones to transfer money via SMS. It became very successful, because it was the first app to include people without access to a formal bank account (Marchant, 2015, p.8). Those two technological innovations applied in Kenya gained such an international reputation that today, various actors throughout the world are using them: Ushahidi, for example, was used by 'Document Hate' during the US election in 2016, and M-Pesa was introduced in Romania by Vodafone in 2014 (Vodafone, 2014). Following this awareness of Nairobi as a place of technological knowledge production, development agencies and private corporations such as Google, IBM and Microsoft have invested heavily in Nairobi's start-ups and co-working spaces.

A relatively new phenomenon in Nairobi is the emergence of a 'maker scene', which focuses on the development of 'stuff' and hardware rather than the well-funded software development community. Engine[2], the first makerspace in Nairobi, opened its doors in December 2015 with the financial support of private investors and charity organizations. It was established as a solution to challenges faced by hardware companies, engineers and other people who aim to develop new (hardware) technology in Nairobi. Those challenges include the high taxes on imported resources, such as basic soldering wire, little 3-5mm screws for electric circuits or a huge CNC (Computerized Numerical Control) machine, that often render imported goods too expensive to buy (Mungai, 2015). Thus, many engineers in Kenya lack access to resources and machines to prototype cheaply and quickly. Sending a digital model of a prototype to specific companies in the US, getting it built there and then shipping the finished prototype back to Nairobi is one strategy for prototyping that is cheaper and quicker than in Nairobi. Nevertheless, it is a more time- and money-consuming process for Kenyans than it is for engineers in the US or UK. Not only are individuals challenged as they attempt to gain access to the resources and machines used for building and prototyping, but, in addition, small Kenyan start-ups often do not get deals with global hardware suppliers. To address those needs, Engine offers its members access to high-quality machines. With those offers, Engine consciously separates itself from the amateurish 'Do-It-Yourself' stance of many global makerspaces by particularly looking for professionals who have an idea that can be marketed in Kenya (head of operations at Engine, interview, 2015). Its overall vision is to support the development of technologies "Made in Africa, for Africa" and an overall "fourth industrial revolution" in Kenya (Birkelo, 2017; Gachigi, 2017).

Nevertheless, the 'revolutionary' vibe of tech production in Nairobi has its limits when confronted with the challenge of raising funds and investments for tech projects. A research partner of mine, the former Head of iHub [3] Research, problematizes the dependency on the values, imaginations and resulting requirements of funders and investors, and demands that local innovators stop "dancing to the tune of whoever wants to listen", as the quote at the beginning of this section states. Therefore, this paper

argues that tech developers and start-ups in Nairobi have to constantly negotiate between liberating feelings about new work possibilities on the one hand, and on the other, restrictive requirements of international funders and investors who still pursue exoticized imaginations of lives in a generalized 'Africa'. I claim that those negotiations lead to the reiterative process between performing deficient environments and building technology that has social impact on broad problems like poverty. For this reason, I refer to Butler's paper on "Performative Agency" (2010), where she states: "It is not only the explicit speech act that exercises performative power. [… I]t is not simply that a subject performs a speech act; rather, a set of relations and practices are constantly renewed, and agency traverses human and non-human domains" (Ibid., p.150). With this new socio-material stance in her arguments, Butler distances herself from the "cultural constructivist position" that she argued for in *Gender Trouble* (1990) (Ibid., 2010, p.153). Based on that socio-material notion of performativity, I call the performative practices around tech development in Nairobi that materialize and stabilize the norms of social impact a *performance of poverty*.

To illustrate these arguments, the paper proceeds as follows: firstly, I describe the ethnographic data collection on which this paper is based. Secondly, I outline why a makerspace in Nairobi is called a revolutionary act: on the one hand, because it faces the challenges of manufacturers and hardware innovators in Kenya, and on the other hand, because it creates international awareness around technological development in order to counter stereotypes of a passive and needy place in the Global South. Thirdly, the paper shows how the slogan "Made in Africa, for Africa"[4] highlights the paradox of the simultaneous critique and reproduction of (post)colonial stereotypes causing 'othering'. Fourthly, the paper deals with the postcolonial power asymmetries inherent in receiving money from international funders and investors for technological ideas. The imaginations of those companies and development agencies are described as tech-deterministic, social-impact-driven and charitable, and the strategies of tech people in negotiating those imaginations are shown. Finally, the paper concludes by drawing on Judith Butler's (2010) theory of performativity to argue that the dominance of social entrepreneurship practices in a postcolonial context implies a reproduction of (post)colonial imaginations and, thus, the performance of poverty.

Ethnographic Research in a Tech Scene

The following paper is based on ethnographic research conducted in Nairobi between 2015 and 2017. During those years, I accomplished three research stays, working in total about six months in Nairobi. By collaborating with several (co-)working places, my research focuses on places and practices of innovating and making hardware in Nairobi. Hereby, the research particularly looks at the daily lives of those people who still constitute the minority of the innovation scene in East Africa: manufacturers and engineers of hardware and electronics. During the research stays, I had the chance to participate

at iHub Research; work as an intern at Engine, the first makerspace in Kenya and my main research partner; and attend numerous tech events, such as hackathons, competitions, panel discussions, etc. Thus, my empirical data consists of 'ethnographic research' insights (Crang and Cook, 2007): I mainly used participant observation to bodily experience the everyday practices of developing hardware at Engine (Carr and Gibson, 2017). Additionally, the research is based on qualitative interviews with actors who were not directly involved in my daily life, such as CEOs of hardware companies, influencers in the tech scene, and political and juridical actors. As an important part of my participatory research and aim to approach some principles of the 'Charter of Decolonial Research Ethics', I organized round-table discussions to discuss preliminary research results with the people I worked with. My exploratory research soon immersed me in sensitive topics such as the stressful working conditions of a hardware entrepreneur, race categories and their discriminatory effects, and personal visions and role models of Nairobi's tech enthusiasts. Using some of those intimate insights in this paper, I decided to anonymize all research participants, even if some did not mind being named in a publication.

Conducting repeated research stays during a time frame of three years allowed me to continuously work with several research participants. Thus, I could observe and participate in various institutional changes at Engine: its first construction and the visions around it (2015); its operation and functioning (2016); and its move to a much bigger space as a way of further professionalizing its aims (2017). Throughout those changes, I worked predominantly with the staff and members of Engine and had little access to those people who manage and account for the makerspace. Perhaps an 'organizational ethnography' (Ybema et al., 2009), which allows a researcher to stay for a long and continuous period of time, could have enabled participation in the daily lives of the people with management responsibilities, aiming at the understanding of further rationalities and global connections around makerspaces. Additionally, research that allows for high mobility could trace the numerous entanglements of making practices through a 'multi-sited ethnography' (Marcus, 1995) by following global practices of making and hacking. Global connections through travelling entrepreneurs enmeshed in transnational accelerators, conferences, etc., or other specific sociomaterial techniques that are packed into ideas and "management recipes" (Orlikowski and Scott, 2008, p.464) could be followed to illustrate how those global connections frame the daily practices of makers and other innovative people.

Again, my research combines multiple experiences, solely within Nairobi and with people and materialities only referring to various global places that also lie 'outside' of Nairobi, be it "Silicon Valley", "China" or "Kisumu". Thus, the paper builds on the global discourse about 'revolutionary makerspaces' and offers glimpses into local narratives and practices being resistant, supportive and contradictory, but entangled. When using the term 'narrative', I follow Czarniawska (2004, p.27): "Everything is a narrative or at least can be treated as one. Usually, however, a narrative is understood

as a spoken or written text giving an account of an event/action or series of events/actions, chronologically connected. Indeed, it is easy to say what is not a narrative even if it is a text: a table, a list, a schedule, a typology."

Making New Technologies in Nairobi: the Revolutionary Practices

Looking at the discourse on makerspaces, the majority of academic and popular literature praises the advantages of digital fabrication for education (Blikstein, 2013; Benton et al., 2013; Halverson and Sheridan 2014; Martin, 2015; Vossoughi and Bevan, 2014) and the inclusion of grassroots people in technological development through makerspaces (Kera, 2012; Smith et al., 2013). It seems that schools, public libraries or other educational institutions see the practices of making and a specific "maker mindset" (Martin, 2015, p.37) as tools that are highly inclusive for children and families alike (Benton et al., 2013, p.31; Sivek, 2011, p.12). They do so by enabling children in areas of creativity, problem-solving, collaborative work, experimenting and accepting failures (Blikstein, 2013, p.18; Vossoughi and Bevan, 2014, p.46). Despite education, makerspaces and hackerspaces are seen to spur the democratization of science development through the participation of grassroots people in experimenting with scientific knowledge and technologies (Kera 2012; Lindtner, Hertz and Dourish, 2014, p.4). The possibility of a subsequent increase in "user control over technologies" shows the appreciation of the political power of makerspaces and hackerspaces and the importance of raising awareness about the developer-technology-user relations (Maxigas, 2014, p.11). In general, the majority of the literature on makerspaces predominantly contains either the hype about innovative spaces that will foster education, or the call to use the political power of making[5].

Many euphorically described advantages of makerspaces are also experienced by individuals using the makerspace Engine in Nairobi: most of Engine's users call it "revolutionary" because it allows for learning through practice, and embodies approaches contrary to those of the engineering education offered at universities. Many engineering students and potential employers complain about the outdated curricula of Nairobi's universities: "The universities in Kenya are too bureaucratic and not teaching the right stuff in the classes. [… S]tudents still learn the same computer languages that they were being taught eight years ago, even though current technology has changed. The people [prepared for working in a technological company] are usually the ones that are self-taught" (Hersman, 2017, p.52). Therefore, it is not surprising that all members of Engine are characterized by an extreme will to learn and build something in practice. One of the interns at Engine told me what he likes most about working at the makerspace:

> In Kenya, what normally happens is that we have repairs, which is the main work offered
> out there. So for an engineer, you study, you understand a lot of concepts, but the only

work that you get is to maintain what others have designed. […] I would like to work in places which deal with more interesting and challenging things, like coming up with solutions, again empowering others to come up with solutions, which is exactly what is being offered at [Engine]. […] I think [Engine] is one of the best places on earth.

(former intern at Engine, interview, 2016)

The intern at Engine feels "empowered" by prototyping with digitalized machinery because, as a studied engineer, he strives for a different job than just repairing imported goods. As a person who feels empowered by developing technology to solve problems in his respective context, this intern embodies the dominant representation of makers. Sivek (2011, p.21) analyzed the discourse created by the most influential magazine on making, MAKE Magazine, and found out that "the contemporary maker is elevated to a societally significant problem solver, working on behalf of the nation and world, and within a community of makers, but still an individual who determines his or her own path". Therefore, making constitutes "a proactive response to social and economic change" (Ibid., p.23). Scholars who are focused on making and subjectivization have thoroughly explored how people adopt a maker identity and what it means for them (Davies, 2017; Lindtner, 2013; Toombs, Bardzell and Bardzell, 2014), as well as how global discourses on innovation and making subjectify people into "entrepreneurial citizens" who are "celebrated in transnational cultures that orient toward Silicon Valley for models of social change" (Irani, 2015, p.801). This paper makes a small contribution to these debates by elucidating, as stated in the methodical part above, multiple and contradictory narratives about and of makers in Nairobi that show the impossibility of talking about a generalized archetype of the 'Kenyan' – or, worse, 'African' – maker.

Countering Eurocentric Narratives on Technological Innovation

When looking for literature specifically on makerspaces in the Global South, the results are scarce. Historical accounts on the emergence of makerspaces omit places in Sub-Saharan Africa, as these places often do not have a long history of institutionalized making. Thus, the genealogies of hackerspaces and makerspaces focus on the characterization of makers forming a counterculture or Do-It-Yourself/repair movement against capitalist structures in post-Fordist environments (Maxigas, 2012; Sivek, 2011).[6] Therefore, it seems that the majority of literature around making and innovation reflects the hegemonic story about the relation between the Global South and technology:

The story of the [Global South] and technology if it is told at all is one of transfer, resistance, incompetence, lack of maintenance, and enforced dependence on rich-world technology. Imperialism, colonialism, and dependence were the key concepts, and the transfer of technology from rich to poor, the main process [that have been focused on].

(Edgerton, 2007, p.92)

The underlying assumptions of a linear exchange between a putative center of innovation, which is the Global North, and a periphery that consists only of consumers of innovation, lying in the Global South, can be traced back to communications professor Everett Rogers (2003), who published his theory of "Diffusion of Innovations" in 1962. Based on his work, the diffusion model was used to explain that people in the Global North innovate, while people in the Global South adapt technology, if anything (Rogers, Ascroft and Röling, 1970; Havelock, 1979). By now, the theory has been highly criticized by various scholars, e.g. for its assumption regarding the universal applicability of technology due to intrinsic properties, and the conviction of a linear exchange (Akrich, Callon and Latour, 2002; de Laet and Mol, 2000).

Nevertheless, the fight against the clichés of the superiority and universality of knowledge and technology coming from the Global North (and predominantly from Silicon Valley) still defines the daily lives of technological developers in Nairobi. The stereotypes of putative dichotomies that are created through academia, mainstream media and developmental practices resemble a postcolonial continuity. Thus, a makerspace like Engine is not only 'revolutionary' because it empowers individuals and hardware start-ups, but because it is also used in a collective act to create international awareness around technology production in Nairobi. This awareness is often deployed to turn the Eurocentric innovation discourse upside down by showing an environment that differs from the stereotype of a passive Global South, which only acts as a recipient of technologies from the Global North. The former Head at iHub Research emphasized that through all the people who are producing stuff in Nairobi, "the image is starting to change and people are starting to realize that we also have a place in this changing tech scene, here in Nairobi and globally and in the region." (tech expert and researcher, interview, 2015). Avle and Lindtner (2016) also wrote about one of their interlocutors in Accra who explained that it is important to create awareness around technology production in Sub-Saharan Africa to deny an image of passive people: "[…] it is about Africans taking ownership of the problems of Africa. It's about Africans creating the solutions that help solve and lift the multitudes of Africans who are in poverty out of that … It's no longer about sitting down and having Westerners come in to the continent to do charity." (Gregory Rockson cited in Avle and Lindtner, 2016, p.2233). Furthermore, a researcher and education tech expert in Nairobi scrutinizes the question of ownership. In her opinion, it is important to interfere in the dominant narrative about tech in Kenya – especially in academic discourses – because they are driven by people who are not a daily part of the innovation scene in Nairobi: "the fact that […] we were able to access that research by participating in the conference, helped us to correct the narrative [… of] what's being told out there" (education tech expert, interview, 2015).

"Made in Africa, for Africa" – Two Sides of a Coin

In addition to going to conferences on innovation, giving TED talks and writing blog articles, there is another specific strategy to create visibility for technological knowledge production and to fight against the superiority and universality of knowledge and technology coming from the Global North: namely, to brand products and projects "Made in Africa, for Africa". Be it an internet modem, water barrels or a makerspace – all are branded as being innovated and produced in African countries for African contexts. "Made in Africa, for Africa" is more than a brand for technology developed in Nairobi; it is the claim for expertise, for having the expert knowledge about what is best for one's own context and what to make and build for it. One example of this kind of marketing is used by the hardware company BRCK. Advertising their BRCK internet modem as 'born in Africa and made for Africa' shows the conviction of the developers: "you can't effectively engineer for the realities of Africa if you don't experience the realities of Africa" (Walton, 2014). Asking the CEO of BRCK what the "realities of Africa" are, he answered that "only […] if you get dirt under your fingernails, you get thorns in your legs, you get sunburn on your face and really deal with the harsh realities of Africa, you will understand Africa" (CEO of BRCK, interview, 2015). For BRCK's employees, their internet modem is "a solution that is born out of Africa under the specific situation here" (Reg Orton cited in Manske, 2014, p.7). Those statements and the advertisement show the conviction of the developers at BRCK: contextualized design of technologies is important, because designers from abroad are not able to grasp the context specificities of Kenya.

Despite the idealism of presenting a place in the Global South that is able to develop high-tech solutions for its local needs, independent from so-called centers of innovation, the slogan "Made in Africa, for Africa" nevertheless evokes exoticized and generalized images of an 'Africa'. If we look at the advertisement of the already-mentioned BRCK, we see the presentation of a technical device that is robust like a brick, works (among other functionalities) like an internet modem and is especially made for "harsh environments" (Mushakavanhu, 2017). The motivation to develop such a device is the fight against poor internet connections, which shapes daily life, according to its developers (Shapshak, 2017). Therefore, BRCK developed a modem that works even without electricity in case of power cuts, due to its own battery. Additionally, it is built to be repellent to water and dust. BRCK's marketing implies that all of Africa is a "harsh environment", meaning that the continent is characterized by hot sun, dust, tropical rain and disrupted connectivity.

This specific advertisement and its descriptions of the 'local' context remind us of Binyavanga Wainaina's (2006) ironic critique on "How to write about Africa": "[Africa] is hot and dusty with rolling grasslands and huge herds of animals and tall, thin people who are starving. Or it is hot and steamy with very short people who eat primates." Thus, 'real Africa' includes mud huts, starving, helpless, opinionless, uneducated humans, who have their hands outstretched to the benevolence of the caring

westerner. Referring to such descriptions while advertising technology "Made in Africa, for Africa" evokes colonial imaginations of a generalized and 'exoticized' (Said 1979) 'Africa', which is constantly compared and 'othered' against sites in the Global North. Referring to concepts of 'othering' following Gayatri Chakravorty Spivak (1985), I want to show that reducing 'others', in this case the target group for a technology, to inferior stereotypes means that knowledge and technology belongs to the 'master' (Spivak, 1985, p.256), who would be the tech companies in this case. According to Jensen (2011, p.65):

> Such processes imply reduction and essentialization in the sense that those who are othered are reduced to a few negative characteristics. Consequently, […] othering [are] discursive processes by which powerful groups, who may or may not make up a numerical majority, define subordinate groups into existence in a reductionist way which ascribe problematic and/or inferior characteristics to these subordinate groups.

In the specific depiction of 'local needs' in the BRCK example above, we see that 'local' seems to represent a whole continent, which is imagined as harsh, wild and rural, and the 'needs' as needs of rural and disadvantaged societies. Thus, potential customers in African countries become homogenized and essentialized as poor and in need of technological solutions. Further, the context of the technology's target group is generalized as a rural environment full of deficits (Nduka-Agwu and Bendix, 2007, p.9). Thus, the claim for contextualized design and technology – "Made in Africa, for Africa" – seems to stage African countries as active technological producers on the one side, while evoking and (re)producing the hegemonic imaginations about a lagging Africa on the other. The question emerges: why do the critics themselves use the dismissed tropes of 'an Africa full of deficits'? The answer cannot be found in "the harsh realities of Africa" (see above), but amidst the harsh realities of business life: namely the acquisition of money.

Making New Technologies in Nairobi: the Restricting Imaginations

In the previous part of the paper, we saw that Nairobi's tech scene is presented and perceived as being revolutionary for two reasons: it empowers manufacturers and hardware entrepreneurs to tackle prototyping challenges, and it counters stereotypes of the Global South as a passive place that is dependent on technology from the Global North. In the midst of a revolutionary vibe that represents a collective agenda with individuals who determine their own paths (as Sivek [2011, p.21] describes the representation of makers), techies face the problematic acquisition of money. The following section illustrates the crux of the paper, namely how funding issues in Nairobi differentiate its tech scene from other places in the world by showing postcolonial trajectories of 'dancing to tunes' and of

'strings played out' and how those dependencies lead to the constant balancing between the aims of start-ups and tech-oriented people and the investors' visions.

Money with Strings Attached

As already stated in the introduction, people who work to develop new (hardware) technology face various challenges in Kenya. Besides the high taxes on imported goods and thus the difficult access to resources and machines to prototype, one of the toughest parts of working on a technological idea is gaining the funding to work on it.[7] Until now, the priority for local investors in Kenya has lain in the property market. A start-up owner explains why it is difficult to find local funding: "It's difficult to get angel investors because the property market returns fifteen percent and it's quite a low risk. So no one is ever going to invest in higher risk and lower return" (start-up founder, interview, 2017). Therefore, most of the funds for tech start-ups come from internationally owned firms and organizations that intentionally seek to invest in technological innovations (Njugunah, 2016). In general, the tech scene in Nairobi is characterized by a high number of international private investors, venture capitalists, philanthropic foundations and development agencies that fund innovative people and their ideas. Furthermore, almost all big technology companies, like Microsoft, IBM, Google, Intel, etc., have established their regional offices in Kenya by now (Marchant, 2015, p.8).

The visions of those international funders circulate predominantly around the transformation of Kenya's economic and societal status by use of technology. This vision can be exemplified with a quote from a funder of Engine: "We are confident that [Engine] will transform the environment for invention in East Africa. It will provide a much-needed space for inventors to talk, build, test, and ultimately take their ideas to market. We anticipate that inventions born at [Engine] will make people's lives better and bolster local economies for generations to come" (The Lemelson Foundation, 2014). Thus, the expectations of investors and donors who financially support start-ups and innovative working places in their early phases focus on the social impact of new technologies. "The kind of foundations which fund around hardware development, they see very straight what they want done. They have straight conditions like 'this is what we are looking at, if you fulfill this, we are going to give you funding'. Of course for any development agency social impact is key. They wouldn't just fund a technology thing" (mechanical engineer, interview, 2015).

Not only development agencies but also private investors who fund tech development in Nairobi use a philanthropic stance in their funding. Pearson and Avle (2016) describe the rhetoric of Google and Facebook as "aid language" when talking or writing about their investment in the Global South. They draw "from human rights-based and international development narratives that emphasize global imbalances and position the global south as recipients of the north's largesse and expertise" (Ibid., p.1). In the specific context of Nairobi, Marchant (2015) has studied the assimilation of visions from

private companies and development agencies when legitimatizing investments in technological ideas. She claims that the global trend of corporate social responsibility is only a partial answer to the phenomenon of the social-impact focus of profit-oriented tech companies (Ibid., p.11). The other part is that "the current pervasiveness of interest in technological innovation among development practitioners makes it difficult for the technological innovation sector to disassociate itself from such development objectives" (Ibid., p.10). Thus, it seems that multinational companies do have to refer to social impact in an innovation context, which is dominated by development agencies and NGOs.

This entanglement of private investors and philanthropic donors and their convergence in social-impact aims can be illustrated in a pitching competition in Nairobi in 2015. I sat in the audience and my Kenyan research partner, who is a mechanical engineer, sat in the jury. Other than her, everyone else in the jury was German, representing three companies, the embassy and three foundations. Looking at the jury, the power asymmetry in terms of who grants funds seemed clear. Along with an entertaining support program with salsa dance shows, food, etc., five projects were pitched. The prizes were not declared until the award show took place: every winner would win a German-language course and a monetary prize between five hundred and two thousand Euros, which was only allowed to be used for that particular award-winning idea. When I looked over the jury's scoring sheet and saw their guidelines for judging, what seemed remarkable to me was that out of a total of twenty points that could be given to rate every project, ten were assigned to the criteria "Originality of the Innovation and demonstrated creativeness" and "Impact of the innovation". The other 50% of the scores were divided between "Practicality/Viability of [the project's] application", "Market Opportunity" and "Applicability" and seemed to be secondary criteria. Thus, according to the "Guidelines for judging of projects", questions about the uniqueness of the idea and the possibility of a "fundamental change in processes on the well-being of the community" were considered as more significant than questions of competitive advantage, clear identification of target consumers and sustainability of the project itself. The social impact of a technology is thus more important for the decision to fund an idea than mere for-profit business logics.

Negotiating Funders' Visions of Technology with Social Impact

Due to international investors focusing on technology with social impact, many tech developers I talked to in Nairobi problematize the prevalent expectations and imaginations of technological innovations coming from Kenya. One of the leading tech experts in Nairobi characterizes the investor-developer relations as follows:

> A lot of the money we've seen either in development projects, private companies' investment, VC, angel investing, has been very Americentric. When it comes with Americentric values, it comes with an Americentric thinking. [...] American money just

> wants to know how you change the world. […] So, it's all about whatever centric values
> this money is being attached to. There is no money that doesn't have strings attached.
>
> (tech expert and researcher, interview, 2015)

Those "strings" or imaginations of funders lead to restrictions of who and what is worth of funding. A start-up founder confirmed that it is a must to integrate social impact into the business model to gain funding. According to him, all funders and investors in Nairobi are "impact investors":

> They want nice stories and photographs. Because of that it's not good enough to have a
> sustainable business that employs people and you make some money and you are not
> reliant on grants. That's my definition of impact but for an impact investor, they want you
> to save the world and reduce carbon emissions and increase access to energy. So the bar
> is actually higher for companies to get investment here than it is in Silicon Valley.
>
> (head of engineering at a start-up, interview, 2017)

Another research partner of mine explained how investors aiming for social impact set their own milestones and pester start-ups to achieve them: "They want to know, they want to be sure, they want you to write a lot of literature around your projects and all that. So they are quite conditional" (CEO of an industrial manufacturing company, interview, 2015). Those personal experiences from tech entrepreneurs in Nairobi illustrate what Kish and Fairbairn (2017) wrote when analyzing impact investors (especially those investing in a specific farming project in Ghana): that telling stories about the "compassionate dedication to pulling people out of poverty" is the only means of "how to measure seeming intangibles such as social impact" (Ibid., p.10). Nevertheless,

> impact investor ethics center the value systems of the investors themselves, with little (if
> any) discernible input from broader communities involved or impacted by their work.
> Their cultural reference points and performative modes of self-fashioning as financiers
> who 'do good while doing well' can end up erasing the very subjects they purport to serve.
>
> (Ibid., p.16)

Thus, if a technology project promises to achieve an extrinsically pre-defined social impact, it has a higher chance to gain funding. It seems that the researched Kenyan start-ups and their ideas are not treated as potentially self-reliant small businesses, but as possible success stories about technological impact in Kenya. The effects of being dependent on the values and visions of financial investors are manifold: a developer is not 'allowed' (or financed) to develop tech without a certain social impact, and the supported start-ups and their products are used as successful stories to tell[8].

Nevertheless, business life requires the technological makers to get their projects funded. Thus, they developed several strategies to cope with the requirements and tech-deterministic visions prevalent in their context. An interlocutor who constantly seeks funds for research projects around tech explained the strategy of using "different languages", depending on what the potential money funders would like to hear – even if that means promising to change the world in a tech-deterministic way. Further, she said that handling the various worldviews of funders "calls for patience sometimes, because you are going to deal with a lot of Eurocentric perspectives, you are going to deal with people who are still navigating the idea of Africa, the poor Africa, the lacking Africa, this Africa not rising for all" (tech expert and researcher, interview, 2015). Some entrepreneurs I spoke with use a more direct way of handling problematic worldviews. The founder of a hardware company (interview, 2017) called it "push back" and explained their start-up ideology:

> Yeah, our business is helping access to energy. It's potentially helping to reduce a lot of emissions, potentially helping people with health problems, but we never sort of lead with the impact. We look more at treating our customers like customers first. Rather than cases that we need to help. […] We do a push back when someone says "I want you to measure how long someone saved walking for fuel and impact on xyz". Sometimes, we say, "Rather than measuring impact, let's talk about what you, funder, cook with at home. Do you cook with a cook stove with charcoal? Do you have a solar stove? No."
>
> (Ibid.)

Another push back would be to "limit the number of funders that can come and visit someone's home. A lot of funders say 'I want to visit a customer'" (Ibid.). Despite those coping strategies, tech people are still dependent on getting funds to pursue their work. Thus, being in the midst of such funders' visions, tech developers have to constantly negotiate between their impulse to criticize the investors' assumptions of a lagging Kenya and the obligation to talk about societal progress through technology in order to be supported financially. "We try our best to push back as much as possible. But we also have to be sometimes realistic that if there is no other funding and there is a certain narrative required, we do grit our teeth" (Ibid.).

Making New Technologies in Nairobi: the Performance of Poverty

As we have seen, the imaginations of funders regarding a specific kind of helpless 'Africa' can have severe consequences for technological developers in Nairobi, such as the need to follow unwritten rules of how to behave, produce and discuss technological innovation. Besides the pressure on individuals, start-ups and places of innovation, the circumstances described also have several performative effects. In the final part of this paper, I would like to draw on Butler's (2010) latest notion

of performativity and show that the dominance of social entrepreneurship practices in a postcolonial context implies a reproduction of (post)colonial imaginations and, thus, processes of "othering" (Spivak 1985) and the performance of poverty.

The belief, as embraced by the international funders and investors in Nairobi, that tech can solve social problems has already been criticized by various scholars. The origin of this belief is predominantly ascribed to Silicon Valley. Evgeny Mozorov (2013), one of the most vocal critics of Silicon Valley, claims that the technological scene is pervaded by the "ideology of solutionism", which he describes as "an intellectual pathology that recognizes problems as problems based on just one criterion: whether they are "solvable" with a nice and clean technological solution at our disposal" (Ibid.). He claims that not all problems defined by tech companies are real problems, and that problems with structural or fundamental reasons might need greater institutional intervention and not just "quick technological fixes" (Ibid.). Silicon Valley seems to be a vital promoter of social entrepreneurship while boosting "the idea that entrepreneurship is a catch-all solution, and that a startup culture is the best way to solve any problem" (Marwick, 2013). Dey and Steyaert (2010, p.88) mention that social entrepreneurship has become a grand narrative,[9] which enthuses the media, policy makers, as well as academia. They describe the narrative as "an individualized, messianistic script that incorporates a model of harmonious social change" (Ibid., p.87), whereby the social entrepreneur becomes the active creator and its social context stays passive and awaiting. For Dey and Steyaert, the most problematic feature of social entrepreneurship as a grand narrative is its use as a "general problem-solving blueprint […] that is applicable to any type of context, historical, cultural, and political" (Ibid., p.89).

Although the belief in the ability of social entrepreneurship and technology to solve all problems is a global phenomenon, it seems that its application in postcolonial contexts implies a reproduction of (post)colonial imaginations and thus, processes of "othering". As technology with social impact presupposes a (social) problem that should be solved, the focus on social entrepreneurship in Nairobi presupposes that only social problems exist, without considering other possibilities, such as innovating technology for industrial processes. Thus, the dominating social-impact logic applied by international funders of tech innovation in Nairobi and the marketing strategy 'Made in Africa, for Africa' perform colonial tropes of exoticized and disadvantaged images of an "Africa". Those funders' imaginations and the hegemonic belief in progress through technology enforce parameters of what can or should be developed in Nairobi for Kenyan customers and what not. Therefore, start-ups, makerspaces and individual tech developers are pushed into building devices that focus, e.g., on customers living in rural Kenya, even if they would rather avoid a reproduction of colonial stereotypes and "dancing to the tunes" of 'othering' their daily life contexts.

For this reason, I call the development of technology with social impact based on generalized and exoticized imaginations of specific customers and their contexts in an African country a performance

of poverty. By referring to Butler's (2010) socio-material notion of performativity, I want to emphasize that relations such as those between investors and developers, boundaries between a putative Global South and North and norms of what to build and what not, are not pre-given, but enacted or "invented", as Butler says. "Norms are in the process of being elaborated, adapted for new purposes, and their continuing life, even their adaptability, depends on the inventiveness by which they are produced time and again" (Ibid., p.154). The reiterative process of performing deficient environments by building technology that should have social impact on broad problems like poverty includes the constant negotiation between the start-ups' and developers' business models and technological ideas and the investors' aims and visions. Thus, although actors in Nairobi criticize the dominance of international imaginations of their contexts, they are also used and reinforced by the same actors (people, start-ups or organizations) to gain money and satisfy investors. Avle and Lindtner (2016, p.2234) also found out that the people they have worked with in Accra and Shenzhen "challenged the notion that the west was the supposed center of contemporary design and innovation, while they also productively leveraged the discourse on innovation at the periphery for their entrepreneurial practice". Those performative practices - of both changing the discourse on a lagging Africa as well as developing technology to solve poverty issues – materialize and stabilize[10] the norms of social impact in Nairobi's tech scene.

Conclusion

In this paper, I showed two sides of the emerging maker and hardware scene in Nairobi. First, I illustrated the euphoria about "revolutionary" spaces of technological development regarding educational and work possibilities – be it in academia or in the statements of members of the tech scene. Furthermore, I elaborated that the euphoria has an additional reason, which is deeply rooted in (post)colonial history: namely, the possibility to fight stereotypes of a Sub-Saharan Africa that is dependent on technology from the Global North. These stereotypes are fought by creating awareness around Nairobi as a site of tech development that is globally comparable. In this regard, the branding "Made in Africa, for Africa" is used to position one's "work as previously outside and now participating in a global market" (Avle and Lindtner, 2016, p.2241).

Second, I showed that, in the midst of the idealism of raising awareness about knowledge production in Nairobi, techies are not faced with "the harsh realities of Africa", but rather the harsh realities of business life: the acquisition of money. By drawing on further research insights, the continuing postcolonial power-asymmetries were depicted as manifested in the relations between international investors/funders and start-ups/makers. The monetary relationships include more than financial investment: they include negotiations between the funders' moral requirements based on tech-deterministic social-impact aims and the start-ups' own understandings of impact, technology and

business models. By looking at the imaginations of global investors and the branding of technology that is developed "for Africa", it becomes clear that the need to build technology with social impact 'others' potential customers in Kenya as people in need of solutions. Customers in rural Kenya are predominantly targeted and, thus, the imaginations of rural and poor societies are reproduced. 'Africa' as a whole becomes generalized and exoticized by adhering to stereotypes that 'other' local contexts in relation to sites in the Global North. To conclude, I called the reiterative practices entangled in global discourses on social entrepreneurship, the investors' (post)colonial imaginations of 'Africa' and the marketing of technology "for Africa" and its "local needs" a performance of poverty, whereby norms of what can or should be developed for Kenyan contexts – and what not – are performatively stabilized. In respect to the Special Issue's topic "The Institutionalization of Shared Machine Shops: New Spaces, Networks + Practices", we can conclude that the emergence of makerspaces throughout the Global South often means an institutionalization and formalization of already existing manufacturing practices. These new spaces of making create various prospects, such as job opportunities. Nevertheless, with institutionalization comes a danger of homogenization; not only the numerous activities and visions of making, which range from activist to commercial or both at the same time (Schrock cited in Davies, 2017, p.21), could be singularized. But especially in a post-colonial context, where for-profits and nonprofits unite in a social impact chorus, it is crucial to not leave makerspaces and practices of making prone to the formalization of the same old imaginations that have haunted African countries since European explorers and colonialists invaded the continent. Therefore, de la Chaux and Okune (2016, p.286) advocate for "a more explicit articulation of the specificities and visions associated with technology entrepreneurship [in Kenya, so that] nonlocal actors [are able] to root their expectations and perspectives in local realities rather than in unexamined hopes and expectations". Thus, as long as generalizing imaginations of contexts in Africa are not challenged thoroughly, and the respective experts in Nairobi are not listened to or, more importantly, are in charge of investment decisions, the "revolutionary" practices around making and innovating in Nairobi remain restricted. To end on an even more passionate note, I refer to Kish and Fairbairn's (2017, p.16) beautiful claim:

> To counteract these monovocal narratives, new discursive spaces of dissensus and
> political levers for contestation must be opened up to hold these investors accountable
> to the populations impacted by their work.

Acknowledgements

NOTES

[1] Braybrooke and Jordan (2017) argue that, although practices around making and innovating in places in the Global South have "been going on both well before, and also at the same time, as the [maker] movement's rise in the West" (Ibid., p.30), they were neglected by the dominant Eurocentric narratives around innovations and their origins.

[2] The name has been altered in order to accomplish a minimum of anonymity.

[3] iHub is one of the largest and most prominent Technology Hubs in Sub-Saharan Africa.

[4] Although I'm reproducing the usage of 'Africa' as a single location by showing you specific quotes, I distance myself from that use and underlying conviction that a whole continent can be generalized to a homogeneous context and environment.

[5] It should not be left unsaid that various scholars already scrutinize the praised promises of makerspaces and making. Throughout the paper, I will refer to some of them.

[6] I would like to acknowledge those scholars who, in their own ways, provide detailed and contextualized accounts regarding makerspaces by also focusing on places other than the Global North. See amongst others: Avle and Lindtner 2016; Braybrooke and Jordan 2017; Irani et al. 2010; Lindtner and Li 2012; Lindtner, Hertz and Dourish, 2014; Smith et al. 2013.

[7] For an elaboration on how policymaking processes during President Mwai Kibaki's administration could foster (ICT) innovation in Kenya, see Ndemo 2017.

[8] The strain of storytelling about new technologies in Nairobi, namely writing "the right stories" for funders and the public by serving specific imaginaries of science, innovation and technology is elaborated in Coban (forthcoming).

See de la Chaux and Okune (2017), for a broader assessment of contradictory views about the availability of capital, the constitution of business skills and viable technology markets between technology entrepreneurs, innovation hub staff and investors.

[9] Although Dey and Steyaert (2010) do not define their understanding of 'narrative', they seem to mean written texts, as they scrutinize "how the academic representation of social entrepreneurship can be understood as a political process of narration" (Ibid., p.86).

[10] Performative practices can also be destabilizing through their reiterative manner. In this paper, I only focused on the practices that stabilize a certain discourse.

References

Akrich, M., Callon, M. and Latour, B. (2002) The Key to Success in Innovation Part II: The Art of Choosing Good Spokespersons. In: International Journal of Innovation Management 6(2): 207-225.

Avle, S. and Lindtner, S. (2016) Design(ing) 'Here' and 'There': Tech Entrepreneurs, Global Markets, and Reflexivity in Design Processes. In: Conference for Human-Computer Interaction (CHI), San Jose: 2233-2245.

Benton, C., Mullins, L., Shelley, K. and Dempsey, T. (2013) Makerspaces - Supporting an Entrepreneurial System. Co-Learning Plan Series of MSU EDA University Center for Regional Economic Innovation (REI).

Blikstein, P. (2013) Digital Fabrication and 'Making' in Education: The Democratization of Invention. In: Walter-Herrmann, J. and Büching, C. (eds.) FabLabs: Of Machines, Makers and Inventors. Bielefeld: Transcript Publishers.

Birkelo, P. (2017) Building Makerspaces for the 4th Industrial Revolution. Source: https://medium.com/@cpbirkelo/building-makerspaces-for-the-4th-industrial-revolution-be51e5d76e22 [Accessed 05 July 2017].

Braybrooke, K. and Jordan, T. (2017) Genealogy, Culture and Technomyth: Decolonizing Western Information Technologies, from Open Source to the Maker Movement. In: Digital Culture & Society 3(1): 25-46.

Butler, J. (2010) Performative Agency. In: Journal of Cultural Economy 3(2): 147-161.

Carr, C. and Gibson, C. (2017) Animating geographies of making: Embodied slow scholarship for participant-researchers of maker cultures and material work. In: Geography Compass 11: e12317.

Coban, A. (forthcoming) Same, same but different: Storytelling of innovative places and practices in Nairobi. In: Engelschalt et al. (eds.) Schafft Wissen - Gemeinsames und geteiltes Wissen in Wissenschaft und Technik. Proceedings of the 2nd conference of INSIST, Munich 2016, SSOAR.

Crang, M. and Cook, I. (2007) Doing Ethnographies. London: SAGE Publications.

Czarniawska, B. (2004) Narratives in Social Science Research - Introducing Qualitative Methods. London: SAGE Publications.

Davies, S.R. (2017) Characterizing Hacking: Mundane Engagement in US Hacker and Makerspaces. In: Science, Technology, & Human Values: 1-27.

Decoloniality Europe (2013) Charter of Decolonial Research Ethics. Source: www.decolonialityeurope.wixsite.com/decoloniality/charter-of-decolonial-research-ethics [Accessed 06 February 2018].

De la Chaux, M. and Okune, A. (2017) The Challenges of Technology Entrepreneurship in Emerging Markets: A Case Study in Nairobi. In: Ndemo, B. and Weiß, T. (eds.) Digital Kenya - An Entrepreneurial Revolution in the Making. Basingstoke: Palgrave: 265-290.

De Laet, M. and Mol, A. (2000) The Zimbabwe Bush Pump: Mechanics of a Fluid Technology. In: Social Studies of Science 30: 225-263.

Dey, P. and Steyaert, C. (2010) The politics of narrating social entrepreneurship. In: Journal of Enterprising Communities: People and Places in the Global Economy 4(1): 85-108.

Edgerton, D. (2007) Creole technologies and global histories: rethinking how things travel in space and time. In: HoST 1: 75-112.

Gachigi, K. (2017) Changing gears for the fourth industrial revolution. Source: www.makingitmagazine.net/?p=10250 [Accessed 05 July 2017].

Halverson, E. and Sheridan, K.M. (2014) The Maker Movement in Education. In: Harvard Educational Review 84(4): 495-504.

Havelock, R.G. (1979) Planning for innovation through dissemination and utilization of knowledge. Ann Arbor: Center for Research on Utilization of Scientific Knowledge, University of Michigan.

Hersman, E. (2017) Conversation #2: Exploring the Ideal Role of Government, NGOs, Angel Investors, and Universities for Technology Entrepreneurs. In: Ndemo, B. and Weiß, T. (eds.) Digital Kenya - An Entrepreneurial Revolution in the Making. Basingstoke: Palgrave: 45-54.

Irani, L. (2015) Hackathons and the Making of Entrepreneurial Citizenship. In: Science, Technology, & Human Values 40(5): 799-824.

Irani, L., Vertesi, J., Dourish, P., Philip, K. and Grinter, R.E. (2010) Postcolonial Computing: A Lens on Design and Development. In: CHI 2010, Atlanta.

Jensen, S.Q. (2011) Othering, identity formation and agency. In: Qualitative Studies 2(2): 63-78.

Kera, D. (2012) NanoSmano Lab in Ljubljana: disruptive prototypes and experimental governance of nanotechnologies in the hackerspaces. In: Journal of Science Communication 11(4): 1-5.

Kish, Z. and Fairbairn, M. (2017) Investing for profit, investing for impact: Moral performances in agricultural investment projects. In: Environment and Planning A 0(0): 1-20.

Lindtner, S. (2013) Making Subjectivities: How China's DIY Makers Remake Industrial Production, Innovation & the Self. Presented at the Eleventh Chinese Internet Research Conference (CIRC11), University of Oxford. Source: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2282420 [Accessed 19 January 2018].

Lindtner, S., Hertz, G. and Dourish, P. (2014) Emerging Sites of HCI Innovation: Hackerspaces, Hardware Startups & Incubators. In: CHI 2014, Toronto.

Lindtner, S. and Li, D. (2012) Created in China: The Makings of China's Hackerspace Community. In: Community + Culture: 18-22.

Manske, J. (2014) Innovations out of Africa. The emergence, challenges and potential of the Kenyan Tech Ecosystem. Vodafone Institute for Society and Communications.

Marchant, E. (2015) Who is ICT Innovation for? Challenges to Existing Theories of Innovation, a Kenyan Case Study. CGCS Occasional Paper Series on ICTs, Statebuilding, and Peacebuilding in Africa (4): 1-22.

Marcus, G.E. (1995) Ethnography in/of the world system: The emergence of multi-sited ethnography. In: Annual Review of Anthropology 24: 95–117.

Martin, L. (2015) The Promise of the Maker Movement for Education. In: Journal of Pre-College Engineering Education Research 5(1): 30-39.

Marwick, A. (2013) Silicon Valley Isn't a Meritocracy. And It's Dangerous to Hero-Worship Entrepreneurs. Source: www.wired.com/2013/11/silicon-valley-isnt-a-meritocracy-and-the-cult-of-the-entrepreneur-holds-people-back/ Excerpted by: Sonal Chokshi [Accessed 07 February 2018].

Maxigas (2014) Hacklabs and Hackerspaces: Shared machine workshops. Source: www.researchgate.net/publication/265378243_Hacklabs_and_Hackerspaces_Shared_machine_workshops [Accessed 12 July 2017].

Maxigas (2012) Hacklabs and Hackerspaces: Tracing Two Genealogies. In: Journal of Peer Production 2. Source: http://peerproduction.net/issues/issue-2/peer-reviewed-papers/hacklabs-and-hackerspaces/ [Accessed 31 January 2018].

Mozorov, E. (2013) The Perils of Perfection. Source: www.nytimes.com/2013/03/03/opinion/sunday/the-perils-of-perfection.html [Accessed 04 January 2017].

Mungai, C. (2015) What's holding back Africa's tech startups? Source: www.weforum.org/agenda/2015/09/whats-holding-back-africas-tech-startups [Accessed 06 July 2017].

Mushakavanhu, T. (2017) African manufacturing its own hardware: BRCK internet in a box. Source: http://africanarguments.org/2017/01/06/african-manufacturing-its-own-hardware-brck-internet-in-a-box-haller-prize-3rd-place [Accessed 06 July 2017].

Ndemo, B. (2017) Inside a Policymaker's Mind: An Entrepreneurial Approach to Policy Development and Implementation. In: Ndemo, B. and Weiß, T. (eds.) Digital Kenya - An Entrepreneurial Revolution in the Making. Basingstoke: Palgrave: 339-362.

Nduka-Agwu, A. and Bendix, D. (2007) Die weiße Darstellung „Afrikas" in der deutschen Öffentlichkeit. Wie ein Kontinent genormt, verformt und verdunkelt wird. In: analyse & kritik – Zeitschrift für linke Debatte und Praxis 37/520: 9.

Njugunah, M. (2016) Kenyan start-ups struggle to get 'reasonable' investors. Source: www.capitalfm.co.ke/business/2016/03/kenyan-start-ups-struggle-to-get-reasonable-investors/ [Accessed 05 July 2017].

Orlikowski, W.J. and Scott, S.V. (2008) Sociomateriality: Challenging the Separation of Technology, Work and Organization. In: The Academy of Management Annals 2 (1): 433–474.

Pearson, B.A.J. and Avle, S. (2016) Chasing the "Bottom Billion": Tech companies and the selling of global connectivity. Source: www.academia.edu/31923550/Chasing_the_Bottom_Billion_Tech_companies_and_the_selling_of_global_connectivity [Accessed 10 July 2017].

Rogers, E.M. (2003) Diffusion of Innovations. New York: Free Press [first published in 1962].

Rogers, E.M., Ascroft, J.R. and Röling, N.G. (1970) Diffusion of innovations in Brazil, Nigeria, and India. East Lansing: Michigan State University.

Said, E.W. (1979) Orientalism. New York: Vintage Books [first published in 1978].

Shapshak, T. (2017) How Kenya's SupaBRCK Aims To Solve Africa's Internet Problems. Source: www.forbes.com/sites/tobyshapshak/2017/03/07/how-kenyas-supabrck-aims-to-solve-africas-internet-problems/2/#1a7ad1221270 [Accessed 14 June 2017].

Sivek, S.C. (2011) "We Need a Showing of All Hands": Technological Utopianism in *MAKE* Magazine. Faculty Publications: Linfield College. Source: http://digitalcommons.linfield.edu/mscmfac_pubs/5 [Accessed 12 July 2017].

Smith, A., Hielscher, S., Dickel, S., Söderberg, J. and van Ooost, E. (2013) Grassroots digital fabrication and makerspaces: reconfiguring, relocating and recalibrating innovation? University of Sussex: Science and Technology Policy Research, Working Paper Series SWSP 2013-02.

Spivak, G. (1985) The Rani of Simur. In: Francis Barker et al. (eds.) Europe and Its Others. Proceedings of the Essex Conference on the Sociology of Literature: 1. Colchester: University of Essex.

The Lemelson Foundation (2014) The Lemelson Foundation funds establishment of pre-eminent design and prototyping facility in East Africa. Source: www.lemelson.org/resources/news/lemelson-foundation-funds-establishment-pre-eminent-design-and-prototyping-facility [Accessed 05 July 2017].

Toombs, A., Bardzell, S. and Bardzell J. (2014) Becoming Makers: Hackerspace Member Habits, Values, and Identities. In: Journal of Peer Production 5. Source: http://peerproduction.net/issues/issue-5-shared-machine-shops/peer-reviewed-articles/becoming-makers-hackerspace-member-habits-values-and-identities/?format=pdf [Accessed 19 January 2018].

Ushahidi (2017) www.ushahidi.com/about [Accessed 20 January 2017].

Vodafone (2014) Vodafone M-Pesa comes to Europe for the first time. Source: www.vodafone.com/content/index/media/vodafone-group-releases/2014/m-pesa-romania.html [Accessed 11 July 2017].

Vossoughi, S. and Bevan, B. (2014) Making and tinkering: A review of the literature. Successful Out-of-School STEM Learning: A Consensus Study, Board on Science Education, National Research Council. Source:http://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_089888.pdf [Accessed 26 July 2017].

Wainaina, B. (2006) How to Write about Africa. In: Granta Magazine 92. Source: https://granta.com/how-to-write-about-africa/ [Accessed 10 July 2017].

Walton, P. (2014) The Case for Engineering the BRCK in Africa – Part 2. BRCK Blog. Source: www.brck.com/?p=285 [Accessed 07 July 2017].

Ybema, S., Yanow, D., Wels, H. and Kamsteeg F.H. (eds.) (2009) Organizational Ethnography: Studying the Complexity of Everyday Life. London: SAGE Publications.